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ABSTRACT

The purpose of this study was to determine how physical education teachers and coaches could best help students/athletes increase sprint speed, investigating whether running speed over short distances could be improved significantly through resistance training or specificity training for middle school age students. A total of 70 7th- and 8th-grade students participated (40 males and 30 females). Students were randomly placed in one of three groups. Group one was the control group and participated in regular physical education activities. Group two was the specificity group, which performed sprints at the beginning of class 3 days a week for 9 weeks. Group 3 was the resistance group, which trained for 5 days a week for a minimum of 15 minutes per session using weights and plyometric exercises along with resistance training. Each student completed a pretest which consisted of three 40-yard sprints, recording the best time. After the 9-week training period, students completed a posttest which also consisted of three 40-yard sprints, recording the best time. Results showed that speeds did not increase significantly because of specificity training, but they did increase with resistance training. Some gender effects were apparent. (Contains 42 references.) (SM)

A STUDY TO DETERMINE THE EFFECT OF RESISTANCE TRAINING AND SPECIFICITY TRAINING ON SPRINT TIMES COMPARED TO THE EFFECT OF NATURAL GROWTH DEVELOPMENT OF MIDDLE SCHOOL AGE STUDENTS

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by
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This thesis, submitted by Craig M. Havens, has been approved meeting the research requirements for the Master of Arts Degree.

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ABSTRACT

The purpose of this study was to determine how physical education teachers and coaches can best help students/athletes increase sprint speed. The importance was to determine if running speed over short distances can be improved significantly through resistance training or specificity training for middle school age students. There were seventy (70) seventh and eighth grade students who participated in this study. There were forty (40) male students and thirty (30) female students. Students were randomly placed in one of three groups. Group one was the control group and participated in regular physical education activities only. Group two was the specificity group. This group performed sprints at the beginning of class for three days a week for a nine week period. Group three was the resistance group. This group trained for five days a week for a minimum of fifteen minutes per session using weights and plyometric exercises, along with resistance training methods. Each student was given a pre-test which consisted of three forty yard sprints, recording the best time. After the nine week training period, the students were given a post-test which also consisted of three forty yard sprints, recording the best time. This study showed that running speeds did not increase significantly because of specificity training, but did increase with resistance training. The data were analyzed using a t-test of gain scores. Inter- and intra-gender groups were also compared and had similar results.

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Chapter One: Introduction

American society today not only expects educators to provide its children a good education, but also expects the school system to provide help in solving a variety of social problems. Schools have been given this added pressure because "society's middle-class institutions, such as family, church and clubs" have assumed a role as the responsible teacher of "values and acceptable morals." (Lays, 1991) "Schools now are expected to teach about AIDS, sex, drug abuse, hygiene, family life, parenting skills, nutrition, driver's education, fitness, and conflict resolution." (Lays, 1991) In some way, all subject areas meet the needs of society by dealing with these societal problems. Yet the area in which more influence on these problems can be asserted is often the most neglected and overlooked in terms of its importance: Physical Education. Many problems are exhibited by children who have low self-esteem. Physical education classes, and athletics provide opportunities for students to gain self-esteem by affording them the chance to participate in activities in which they may excel. Physical education teachers may be more able to enhance their abilities, thereby affording them more opportunity for success and self-esteem to grow. Exercise often acts as a replacement for something that individuals feel is missing from their lives. Many have a tendency to equate their self-esteem with their athletic achievement. (Sherman, 1989). By looking at the problems to be addressed, many of these problems, such as drug abuse, teenage pregnancy, and poor hygiene, are participated in by those with poor self-esteem; by improving self-worth or perceived self-worth, a positive impact may be made on societal problems.

Introducing middle school-aged children to a variety of training methods may help them become successful early in their physical development. With this success, confidence will hopefully grow. Many middle school-aged children often perceive themselves as inferiors in their peer group whether it is caused by their genetic makeup or the fact that they have not developed motor skills comparable to others. A program devised properly to help develop one major motor skill such as running, can have a positive effect on the student's overall outlook.

Running is a great exercise to help children develop muscular strength, cardiovascular endurance, agility, coordination, lower blood pressure, and to help reduce stress. (Herzfeld, Powell, 1986). Various training methods and exercises including weight training (isotonic), resistance training, isometric, flexibility, distance running, agility drills, kinetic awareness and many more can be used to help improve students' abilities to run faster. This ability should have a carryover effect to participation in a particular sport or event.

Another reason to concentrate on increasing the foot speed of the students is the fact that it does not take a great reduction in time to be significant.

Statement of Problem

The purpose of this study is to determine if resistance and specificity training for middle school-age children will have a more positive effect on students' foot speed than running sprints or natural gains that are made through normal growth.

The Hypothesis

The hypothesis of this study is that resistance and specificity training for middle school-age children will have more impact on increasing their foot speed than either running or normal growth and development.

Purpose of Study

The purpose of the study is to determine how physical education teachers and coaches may better help their students or athletes become faster, thereby giving them a better opportunity for athletic success.

Significance/Importance

To better enhance students' and athletes' abilities to reach their full potential, one must give them the chance to compete for scholarships and other viable rewards.

Assumptions

The assumption is that the students tested are typical twelve, thirteen, and fourteen year-olds and that the instruments utilized were consistent, reliable, and valid. It was also assumed that the sample is adequate in size. The time frame was adequate.

Limitations

This study involved 70 seventh and eighth grade students (male and female) between the ages of twelve and fourteen at Montcalm Junior High School located in Montcalm, West

Virginia. The program was limited to a pre-test and post-test for each of the three groups to be tested. The training program lasted for nine weeks which was an adequate time frame.

The Definition of Terms

Acceleration- The change in velocity divided by time interval over which it occurs.

Agility- The state or quality of being agile, nimbleness, or briskness.

Biomechanics- Area of study wherein the knowledge and methods of mechanics are applied to the structure and function of the living human system.

Cardiovascular- Pertaining to the heart and blood vessels.

Cardiovascular Endurance- The ability of the heart, lungs, and blood vessels to send fuel and oxygen to the body's tissues during long periods of vigorous activity.

Exercise- Activity that requires physical or mental exertion, especially when performed to develop or maintain fitness.

Fitness- Readiness: To be appropriate or suitable to.

Flexibility- The ability to move a body part through a full range of motions.

Genetics- Explains the manner in which various physical traits are transmitted from one generation to the next.

Gravity- Attraction between two objects due to their mass.

Isometric Exercise- The contraction of a muscle under circumstances that prevent it from shortening, and is used against immovable subjects.

Isotonic Exercises- Having equal tension or tone: Having the same osmotic pressure as a solution with which it is compared. Constant tension in muscles undergoing concentric or eccentric contraction.

Kinetic- Of relating to or produced by motion.

Physical Education- Education in the care and development of the human body. Stressing athletics and including hygiene.

Plyometric Training- Priestess, the method loading is by using the kinetic energy of the body to put the muscles on stretch and elicit an eccentric contraction followed immediately by a concentric contraction.

Resistance Training Exercises- The use of body weight against gravity.

Running- To move rapidly.

Self-Esteem- How one sees and feels about one's self.

Specificity Training Exercises- The use of specific exercises to achieve a specific goal.

Velocity- Ratio of change in position to time interval over which time takes place.

Chapter Two: Review of Related Literature

In education as in other professions, more and more is heard about "accountability." Accountability may mean that teachers and coaches, might someday encounter lawsuits from those claiming that they were not able to reach their full potential as a person mentally or physically because they were not exposed to the proper activities. This makes it very necessary not only to document the things that physical education teachers and/or coaches do, but to also investigate areas which may enhance students' mental and physical prowess.

Enhancement of mental prowess, while often not thought of at the same time as physical education or athletics, can be greatly enriched by physical exercise and participation in sports. Becoming more physically active in unfamiliar activities the average person can strengthen his or her mind, according to Arnold Schelbel head of UCLA's Brain Research Institute. (Golden, 1992).

According to Harvard Brain Researcher, Marilyn Albert, "We keep seeing a relationship between physical activity and cognitive maintenance, and we suspect that moderately strenuous exercise leads to the development of small blood vessels. Blood carries oxygen and oxygen nourishes the brain." According to the research the activity should be new and should require some thinking. Many Wall Street brokers, lawyers, and analysts have been participating in aerobic fitness programs. These fitness programs are designed to allow the busy executives time to work out before work, at lunch, or after closing. Designers maintain that exercise increases productivity, raises energy, and helps them to relieve tension. (Slafkin, K. 1985).

Putting one system under stress relieves stress on another. (Fixx., J.F. 1977). In the 1980's a growing Apple Corporation was one of the first to introduce employees to the counterculture of health consciousness by offering healthy snacks and company based fitness programs, even providing measures to help relieve the program workers' tension. Even a power struggle in 1985 could not change the "collegiate" feeling provided by the company. The intensity was not diminished by the casual dress or work out ethic of its employees. America's "Baby Boomers" are becoming more concerned with physical exercise, not only for reasons already mentioned, but also in an attempt to beat the biological clock. Physical exercise can slow one's physical decline by 50 percent. This has given added meaning to the phrase, "Use it or lose it." (Scruggs, R. 1992).

It has also caused some problems for America's youth. Fitness specialists have noted that baby boomers in their attempt to stay young, raise energy levels and relieve stress, have done so at the "expense of the kids." "While the boomers are swimming an extra lap, or running an extra mile, the kids are likely sitting and watching television, waiting for the parents to pick up pizzas." (Smith, L. 1991). This could very well be the biggest singular contributor to children today being fatter, having less endurance, and in poor medical condition. Many children under the age of ten show early signs of high blood pressure and hardening of the arteries.

Kenneth H. Cooper, known as the "Father of Aerobics" (Leavenworth, D.S., Ironkids, 1992) has long advocated that aerobic exercise is a disease preventive. Exercise, which has many evident contributions to the physical state, may also be just as important to one's mental health. Many individuals exercise primarily as a means of stress reduction. They report a tranquil, relaxed feeling throughout their bodies following physical exercise (Morgan, 1976). Von Euler and Soderburg (1957) studied the influence of hypothalamic and body temperature on the gamma motor system in cats and rabbits. Von Euler and Soderberg noted that moderate body heating elicits drowsiness and relaxation, because of the influence of hypothalamic thermosensitive structures in the cerebral cortex and gamma motor system. (Balog, L.G., 1983).

Proper exercise and good nutrition give one a balanced fitness program, which leads to less medical care. Many athletic injuries have been related to poor diets. This is especially true during conditioning phases of athletic events or exercise programs. People who start a vigorous exercise routine without having adequate supplies of vitamins, proteins and minerals stored up to meet their bodies' needs are risking injury. Therefore, before undertaking a new fitness program people must be sure that any diet needs are adequately met. (Heck, K., 1983).

To ensure that a balanced fitness program is implemented, it is a good idea for parents and children to be involved together in the program. Families who participate in such programs will see many benefits ranging from having fun together to the amount of money they save by being healthier. Better diet and physical conditioning means eating less fast food (very expensive) and fewer medical bills on the average. Even with all the benefits, most Americans would rather wait until something goes wrong and are forced to do something about it before making a change. Dr. Cecil G. Sheps, expert on public health, blames "the nation's traditionally short-sighted approach to preventative care for a host of long tem ills". Health problems can get scant attention or funds until they reach near crisis proportions. "Preventative measures, having no powerful constituency, end up at the bottom of the priority heap" (Montgomery P. 1989). These same ideas explain why so many Americans give little support, or attention to develop a balanced fitness program for families. However, these same people will be the first to point fingers and place blame on physical educators and coaches for American children not being in good physical condition, especially when high priced doctors inform parents that a child's problems could have been prevented through proper diet and exercise. (Montgomery, P.,1989).

Dr. J. H. Knowles, President of the Rockefeller Foundation, "argues that the next big change in medicine will come through changing our lifestyles". One of the simplest, easiest ways to change lifestyles favorably is by exercising. Before starting exercise programs it is very important to establish a routine that includes the components which are essential for it to be successful. Exercise routines should include: warm-ups, stretching, high intensity work outs and a cool down period. These components will afford the best chances for success, and will help to prevent injuries. One of the easiest, most relaxing and least expensive high intensity exercises is running. This makes it important for physical educators to incorporate a positive running program into their fitness program to provide students the opportunity to gain an appreciation for running (Fixx, J. F., 1972).

Workers who began running in the USSR reduced annual sick days lost per year from 436 to 42. Extremely overweight people have significantly improved their condition in as little as three weeks. With this information along with other information that has recently been gathered it is no wonder running is making a come back as a very beneficial exercise. In recent years many physicians, understanding the importance of running as a preventative, have begun using running programs as preventive medicine. Dr. George H. Sheldon, a cardiologist says running "is a physiologically perfect exercise." Running uses large thigh and leg muscles in rhythmical fashion at a personally controlled rate, reducing the chances of heart attacks, chronic tension, headaches, and helping people to stay young. (Fixx, J.F., 1972).

With all the benefits of running it is hard to understand why so many youth have such a negative inclination towards this wonderful exercise. Physical education teachers, by playing on children's competitive nature may be able to increase their desire to run and help provide them with a more positive attitude toward running. Children by nature have trouble relating to long term goals, yet are very interested in meeting short term goals. By giving students short term goals that are attainable teachers may be able to instill students with a positive attitude towards running. This attitude change would hopefully translate into more student participation and success, with a long term carryover effect. Running is generally measured in two ways: the distance one is able to run, and the speed at which one can run a specific distance (Zitzewitz, P., 1992). Distance, being either long or short gives a constant to use to measure improvement made in the speed at which the runner covers the specific distance. Improvements made in the speed at which one covers certain distances would be used as attainable short term goals. When improvements in a person's speed are measured, the important thing to remember is that a very significant gain can be made by a very minute change in the time one covers a certain distance. Speed or the concept of speed is "relative" based on the speed of light. Measurement of an object's speed relative to another object will always be placed within the limits of the speed of light. Zero is rest and the speed of light is 186,000 miles per second. The speed of light in units of miles per hour would be :186,000 miles*3600/ secs*1 hr = 6.7 * 10 miles/hr 669.600,000 miles per hour. Comparing this to the average human range of 5-25 miles per hour only covers .0000037% of the possible speeds. 25 miles / hour/669,600,000 = .000000037 * 100 = .0000037%. Within the constraints of human speed an increase would be insignificant based on an object's possible range, while in comparison a 2% increase in a human would be a very significant increase. (Zitzewitz, P., 1992).

Genetic make-up and Biomechanics will only allow for a certain amount of gains in one's speed or other muscular performance motor skills. J. H. Hay, B. D. Wilson, and J. Dapena all of the University of Iowa conducted a study designed to identify the limiting factors in the performance of basic human movement. This group wanted to "determine the nature and strength of the causative relationships that exist between biomechanical parameters and the quality of performance of a motor skill and to identify biochemical parameters that are instrumental in limiting the quality of performance". They used a three-step model in their research strategy. Step one was the development between dependent variable and contributing independent variables. Step two was the collection of data from a wide range of individuals and abilities using a large number of subjects. Step three was evaluation of the performances (Kreighbaum, Barthels, 1981).

The research was successful in showing "some promise of ultimately being effective in determining the factors that govern the quality of performance of a motor skill." Significant relationships were found between relative segment lengths and segment angles.

In addition, a correlation existed between angles, flexibility, and performance (Kreighbaum, Barthels, 1981).

According to Zatziorsky in 1974, "biomechanical parameters and the criteria for physical performance generally take one of three forms: linear, curvilinear, and tapering." (Komi, P. V., 1976). A biomechanical parameter that shows a cause-effect relationship exists should then be looked at as the area in which performance could be improved. (Komi, P. V., 1976). Sprague P, and R. V. Mann studied the effects of fatigue on the Biomechanics of sprint running. To compare kinematic and kinetic effects, volunteers were filmed during a performance of a long sprint intended to reach the point of fatigue and a short maximal exertion sprint. They were able to observe noticeable differences during the ground-phase, where power is of a premium. (Sprague, P. S Mann. R. V., 1983). Bates and Haven (1974), who conducted a study of highly skilled female runners concluded that stride frequency, stride length, and horizontal velocity all decreased when fatigue became more prevalent. A one on one correlation could be made for the decrease in stride frequency and an increase in the time of the support phase. However Bates and Haven conducted the study on an aerobic event rather than an anaerobic event.

P. F. Radford and A. R. M. Upton examined trends in speed alternated movement. Sprinters have faster stride rates than do long distance runners; however, stride rates cannot be measured above leg lengths. Velocity, the muscle's capacity to deliver energy during contraction, stride length, and limb structure must also be considered. Hoffman (1972) has demonstrated for the special case of sprinting, "stride ratio is closely related to leg length." Tanner (1964) emphasized the importance of limb structure. Radford and Upton's study was designed to measure the rate at which simple, rapid, and alternated movements could be performed. One hundred and thirty-nine males and females, 5 to 75 years old scored on a tapping test. Age differences in performances show a difference in alternation ability during developmental years. This increase could reflect on the developing nervous system. Accuracy also increased with age as objects distinguished between specific muscle groups and whole limb. This study does show a certain relationship between increased speed and the nervous system. If this is the case and is proven then to increase speed, methods should look to activities such as fast treadmills, and rapid bicycling among others (Burke, 1979).

As mentioned earlier when one tries to increase speed, only a small decrease in time is necessary to be significant; therefore, it is important to look at areas from the start that may affect the speed of a runner. W. Baumanm did research on the sprint start. In short distance runs a good start is essential to a good time. Important in having a good start is the great amount of force that is exerted in the horizontal direction, which depends greatly on hip, knee, and foot extensor muscle strength. It has also determined that in a race of 100 meters the start time has very little to do with the performance. (Komi, P. V. 1976).

When one tries to increase an athlete's speed, particularly by a sprinter, it is essential to have a good start. As stated earlier, strength is very important to getting out of the blocks to start the sprint. Antti Mero, investigated to find out how force time and running velocity of sprinters were intertwined. Mero's study was "designed to analyze the force time characteristics during the first contact after leaving the blocks", because of the lack of detailed information on reaction forces during this phase. "An analysis of the relationships between force production and velocity at the beginning of the run." (Mero, A.,1988). Results indicate a high correlation between force production in the blocks and blood velocity, which supports the emphasis for high level fast force production for sprinters. The importance of strength during the acceleration phase of sprinting is also shown by a high correlation coefficient between force production during the propulsion phase. Because of the importance of having a strong start many training devices have been designed to help produce both maximum power with quick burst and also work on improving reaction time. Speedstep, high-step runner, reaction coaching, and strength leg training system are all designed to decrease reaction time and develop a powerful quick burst (Mero, 1988).

Another study conducted by Y. Murase, T. Hoshikawa, W. Yasuda and Y. Ikegami and H. Matsui, was concerned with “variations in running speed, running forms, and the anaerobic energy output in the 100 m sprint and the relationships of these variables” (Komi, P. V. 1976). Results showed almost maximum speed at the 30 m point from the start. These conclusions showed no significant differences in vertical movements even with subjects of different abilities. Leg speed of the excellent runners was greater than for a poorer runner with the same stride length. The excellent runner shows the highest amount of anaerobic power, and the decline in running speed during the deceleration phase is directly related to the decrease in anaerobic power over of the course of the run, (Komi, P. V., 1976).

Biomechanical research is conducted in hopes of optimizing human motions. Researchers have taken a variety of ways to accomplish this, trying to prove one area of study more significant than another. However, the findings show all areas have a distinct effect on the other areas. This means that when trying to make or reach optimal levels one can not concentrate his/her efforts on just one area of biomechanical research. Anatomical considerations must also be given great concern (Kreighbaum, Barthels, 1981).

After taking all the major research conducted along the line of Biomechanics and putting all of this into the most physiologically correct exercise program possible, along with training the nervous system with neuromuscular mechanisms, the degree of increase in performance from average would not necessarily reach a high level of competition. Genetically, humans set limits or place limitations on how much improvement they can make (Komi, 1976).

Genetics is probably the most widely studied science on earth. Famed monk Gregor Mendel, who is also referred to as "the father of genetic science" discovered tiny units known as chromosomes, located in cells and now known as genes, which determine the traits an organism receives. Deoxyribonucleic Acid (DNA) contains the instructions for cells to follow. Speed, and performance of athletes has a predominant reliance upon heredity. The anatomy of muscle structure shows that muscles are made up of two types of fibers, red and white. Red are indicative of slow twitch and it is believed that people will have slower reaction times and also not perform as well in short bursts or sprint events. Those who possess mostly white fibers, known to be fast twitch muscle fiber, perform much better in quick burst reaction time and sprint events. Each individual is born with a certain proportion of these fibers and this proportion cannot be changed by training. Humans are literally locked into a system that is going to make some of them predominantly fast or slow, others endurance oriented, and the rest fall at graduations between these extremes. (Burke, E. J., 1979). The chemical structure of red fibers, containing more myoglobin than white fibers, make them more able to carry on an aerobic workout, more suited to endurance, and able to work more effectively. These muscles contract more slowly and are generally not used once movement becomes fast. White fibers are adapted for fast movement and mostly used during an all out burst, or at a peak level. Although they have various differences, it is postulated that red help white overcome the inertia of the body at the beginning of a movement (Burke, 1979).

Though the amount of red or white muscle fibers seems to remain constant, the size can be altered. This would be desirable because it would increase the speed potential of the muscle. It is believed that the two best ways of exercising to increase the size of the muscle fibers is to perform activities either at high speeds or isokinetically at a fast speed. Biopsies of sprint athletes who do high-resistance, low repetition exercise at fast speed on isokinetic equipment show an increase in white fiber size while red remains almost unchanged. The advantages to this is that white is made stronger and propositional mass is increased. White fibers adapt to the stress of fast high resistance exercise by becoming stronger and faster. Exercising at high speed improves one's ability to contract faster, according to research at Indiana University and the University of California at Davis. (Thomas V. Pipes and Joch H). People still have to accept that because of genetics and the vast difference in genetic limitations, some youngsters who have been trained very little can out-perform others of similar age and size who have under gone vigorous training. (Test-Tips, The Chrysler Fund-AAU Physical Fitness Program).

G. D. Tharp, R. K. Newhouse, & others, decided to compare sprint and run times using the performance on the Wingate Anaerobic Test. This group also wanted to determine the influence of age and weight in the WANT scores. "Fifty-six volunteers were tested for anaerobic power, and capacity using the Wingate Test procedures." (Tharp, G. D., 1985). Many sports or events which demand explosive power rely on anaerobic energy pathways, phosphagen breakdown, and glycolysis to provide this energy. Recently, bicycle ergometer tests have been used to measure anaerobic power, the Wingate Anaerobic Test (WANT) is the most popular. This test makes adjustments for age and weight by adjusting the resistance. "Bar-or and Inbar (1978) concluded that the WANT is a valid predictor of sprinter ability in non-athletic children." (Tharp, G. D., 1985).

The first five-second period or the second was where the highest work was performed. During the entire thirty-second period is the anaerobic capacity and reflects the glycolytic component along with the alactic component of energy release. The difference in correlations indicated that each test probably measured different anaerobic components. These results indicate a weakness in the WANT as a predictor of sprint and run times. A higher correlation existed between the dash than the run, than should be expected because of the two minute run, which tends to become more of an aerobic test. The WANT test becomes a better predictor of dash and run times when adjusted for body weight. Body weight is a critical factor in anaerobic power. The ability to activate large amounts of ATP-creative phosphate, hindered by the increase in age and weight, is necessary to provide energy "for 6-10 seconds of contractions while glycolytic process reach maximum energy release in 30 seconds and continue at a high level for two minutes." (Tharp, G. D., 1985).

Although significant factors such as the influence from neural or blood flow, have no influence, muscle tension alone has been shown to increase the ratio of incorporation of amino acids into proteins and thus cause hypertrophy. Buregona, et al. 1970, stated that high-tension training would provide a packing effect of actin and myosin filaments. Thorstenason 1976, MacDougall 1977, and Costill 1979, have shown that high-intensity short duration training does enhance the ability of a muscle to activate and re-synthesize large amounts of ATP in a short period of time (Costill, Armstrong, 1985).

Forceful exercise increases myofibrillar protein, and repetitive exercise increases the concentration of energy enzymes. This supports this idea, as does the work of many authors who agree that short intense activities increase aerobic capacity of muscles, while low weight, high repetition exercises produce endurance and increase anaerobic capacities of the muscles. These results support the contention that mechanisms which enhance endurance depend more on duration than on maximal intensity. The results support assertions by Delorme that specificity of training for acquisition of muscular strength and muscular endurance is the best way to train. Delorme's concept of specificity of training says that if one is going to be a sprinter, he/she must work for a short burst of time with high intensity and not use low weight, high repetition training. According to Delome, the reverse would hold true if one is training to be a long distance runner. (Anderson, T & Kearney, J. T., 1982).

Regardless of the athletic event being trained for, it is agreed by exercise experts that some type of strength building program is a must. There are various types of programs to choose from: weight training, resistance exercises, isometric, running stair, weighted ball drills, weighted equipment, or swimming. Some of these are familiar to most athletes while others may be new. Resistance exercises refer to the use of body weight against gravity, and weighted equipment such as vests, ankle weights, and arm weights. Any of these programs can be beneficial as long as total body conditioning with an emphasis on the abdominal region, lower back and hamstrings is in place. (Rosandrich, T. 1982).

"It is well recognized that resistance training can enhance muscular performance." (Anderson, T. & Kearney, J. T., 1982). Numerous studies have been conducted which demonstrated improvements in strength and endurance following resistance training. Resistance training and programs can take on many forms. Plyometrics, parachutes, and bands among others have become very popular. Tim Anderson and Jay T. Kearney noted that work done by Berger (1962), Berger and Hardage (1967), Penman, (1969) and others supported Delorme (1945). Penman (1969) measured the acquisition of leg strength obtained through dynamic by extensions, maximal effort isometric by extensions, and running stadium bleachers. The smallest gains were made by running stadium bleachers. He also found a parallel between the number of repetitions and endurance. DeLateur, Lehmann, and Focdyce(1982) challenged Delmore by testing two groups with high resistance, low repetitions and two with low resistance and high repetitions. This group found that either program increased both strength and endurance; thus they concluded that the choice of weights was not the important aspect; rather it was the point at which muscle fatigue is reached. Anderson and Kearney decided to try to find the answer to the differing views; therefore, they conducted a study using three resistance training programs. "High resistance-low repetitions; medium resistance-medium repetitions, and low resistance-high repetitions. Forty-three volunteers who were untrained were used. The results of the study showed gains in strength and endurance for both groups, with the low resistance-high repetition group improving the most. The results support assertions of Delorme and the general concept of specificity of training. It should be noted that except for the relative endurance task for the high resistance-low repetition group, all made significant improvements (Anderson, Kearney, 1982).

One can see that many of the new resistance training techniques being used emphasize the Delorme theory. Coach Pauletto, the developer of the "Power Chute" states that the "Power Chute" combines resistance running and speed running during the run, the two elements to improve speed. When the chute is open, it provides resistance, and by releasing the chute the athlete will run like they have been "shot out of a cannon". (Pauletto, Power Systems 95, page 19). The Power Blaster, speed harness, weighted vest, weighted shorts, ankle weights, and wrist weights have all been designed so that the athlete can be free to move (specificity of exercise, running speed) while training. Dr. Guy Shepard recommends for the development of the pelvic girdle, buttocks, and thighs, that the athlete work with the box squat which is fantastic for the development of power in these areas, which would especially be beneficial to the sprinter during the sprint start. (Shepard, G., 1992).

Plyometrics is another form of exercise which has gained a positive reputation over the last ten years, especially in line with explosive speed and strength. "Plyometrics are anaerobic exercises that are qualitative, not quantitative, with regard to length of performance." (Reinbiller, M., 1994). Plyometrics emphasize short explosive bursts. The explosive nature of plyometrics makes it very important to build a strength base in athletes, especially young athletes, before instituting a plyometric routine. It is essential to start slowly and build as technique and strength improve. The merits of plyometrics have been discussed in journals, but much of the literature has dealt with studies by eastern European scientists. These studies caused what is often alluded to as the "bandwagon" effect; "what's good for the Russians must be good." This type of exercise is isometric which involves a stretch reflex in muscles being overloaded. "Grieve examined the role of eccentric muscle contraction (forced stretching) and stated: (Scoles, G., 1978) "The faster a muscle is allowed to shorten, the less tension it can exert." (Scoles, 1978)

The faster a muscle is forced to lengthen, the greater tension it exerts." (Grieve, D. W., 1970). In sports, where the relationship between maximum strength and explosive-reactive power is of importance, plyometrics are believed to be very useful. Concentric muscle contractions immediately following eccentric muscle contractions are stronger than concentric alone. Gordon Scoles, track coach, conducted a study designed to determine the effects of depth jumping on vertical jump and standing long jump. Both of these are anaerobic activities which have a need for explosive power and strength, as do sprint runners. (Scoles, G., 1978). Unfortunately, Scoles' study, done with subjects training for two days a week for eight weeks, only showed slightly more improvement than the non-exercising control group. The failure of this study to be significant could be caused by the limitations placed on the study. Scoles still believed the slight increases made are enough to show that depth jumps are beneficial in developing explosive-reactive power.

In a study by Stuart E. Blattner and Larry Noble the effects of plyometric training were compared to the effects of isokinetic training. "The purported advantage of isokenetic is that muscles work at maximal force throughout the entire range of motion, every repetition providing a greater training stimulus." Blattner and Noble used analysis of covariance to compare post-test scores with pre-test differences removed. Both groups showed significant improvement with no significant difference between training groups. (Blattner, S. E. & Noble, L., 1979). The jumping test gave reliable results for 11-12 old students. Another study gave reliable results on throwing for the 10 to 12 year old subjects. (Viltasalo, J. T., 1986). Conclusions from these studies show that one may get reliable results on explosive strength by testing or conducting studies on middle-school aged children. Research also showed that training programs of various kinds have been instrumental in increasing strength and explosive power. Some results were not shown to be significant; however, the gains were always shown to be better than the non-training groups. Many of the studies deal with jumping to validate a connection to determine if jumping explosively can be increased. Therefore, anaerobic, explosive sprinting can also be increased by proper training sessions.

The research involved in this study showed a definite correlation between training and positive improvements in athletic events. Therefore, it is safe to assume that students or athletes who become involved in a training program will make more gains than students or athletes who do not participate in a program. Some natural gains will be made as middle school age students develop strength during the developmental years. The gains can be supplemented through training methods. As students make even the slightest of gains, self images improve. A positive self image correlates to success. The purpose of this study is to determine how physical education teachers and coaches can best help students/athletes increase their speed, allowing them more of an opportunity for success and a positive self image.

Chapter Three: Methodology

The purpose of this study is to determine how physical education teachers and coaches can best help students/athletes increase sprint speed, which allows more of an opportunity for success. The importance is to determine if running speed over short distances can be improved significantly through resistance training or specificity training for middle school age students. It is also believed that students of this age will make a significant improvement because of their normal growth patterns. This study compared post-test scores and pre-test scores for three groups of students.

Hypothesis

The hypothesis of this study is that there is no significant difference in the amount of increase in foot speed for middle school age children who participate in training programs and those who undergo no training. The alternate hypothesis is that there will be a significant difference in the foot speed of middle school age children who participate in a training program.

Description of the Program

The specific exercise programs were incorporated into the physical education classes at Montcalm Middle School located in Montcalm, West Virginia. The classes met daily Monday through Friday for 90 minutes each session. Approximately 10% of all instruction time was reserved for this program. The program began with three weeks of exercising to include stretching, running, and jumping, along with strength and endurance building exercises.

After the three week conditioning phase the students were divided randomly into three groups. Group Two practiced specificity training. They ran three sprints 40 yards with a rest of one minute or more between each sprint. The routine was followed three days a week. Group three was the resistance training group. This group trained five days a week for a minimum of 15 minutes per session. Group one was the control group; which participated in regular physical education activities. All groups continued to do warm-up and stretching exercises along with running, to which they would normally be exposed.

Anthropometric Assessments:

There were seventy (70) seventh and eighth grade students, forty (40) male and thirty (30) female students. Anthropometric measurements including height, body weight, and percentages of body fat were recorded. These are dependent variables which were used at the end of the study to compare physical changes that the subjects have undergone.

Procedures for the Program:

All subjects started with a pre-conditioning program consisting of warm-up exercises, stretching exercises, and endurance/strength exercises. Each student was then given a pre-test which consisted of three forty yard sprints, recording the time of each sprint. The best time was recorded.

Students were randomly placed in one of three groups. Group Two performed sprints (specificity training) at the beginning of class. Group Three, the resistance training group, trained using weights and plyometric exercises, along with resistance training methods. Group One was the control group and was only allowed to participate in physical education in-class activities.

All programs took place at the beginning of class three days a week, using Tuesday and Thursday as recovery days. Groups two and three received instruction and encouragement throughout the program. At the end of the nine week training period all three groups were given the post-test, consisting of three forty-yard sprints recording the best of the three.

Test Design

The study consisted of three randomly chosen groups with a pre-test, post-test design. A t-test was used to test the null hypotheses and analyze the data.

The design for this investigation is an experimental, three group, pre-test/post-test design. The data were analyzed using a t-test of gain scores to test the following hypothesis:

1. There will be a significant difference between scores of students who receive specificity training and those who do not.

2. There will be a significant difference between scores of students who receive resistance training and those who do not.

3. There will be a significant difference between scores of students who receive resistance training and those who receive specificity training.

Summary

Two training methods were utilized and compared to determine the impact on student foot speed performance. The purpose of this study was to determine if resistance training and specificity training would have a greater impact on increasing foot speed than running or normal growth and development. The results of this study are presented in chapter four.

Chapter Four: Data Analysis

Middle school pre-adolescent age children vary in athletic ability. The initiation of athletic training procedures should enhance middle school gains on performance based evaluations. The purpose of this study is to determine if running speed can be improved significantly through resistance training or specificity training for middle school students. The population of this study consisted of seventy (70) seventh and eighth grade students enrolled in Montcalm Middle School. The study was limited to rural areas which were geographically and socio-economically similar. The students were randomly placed in one of three groups.

Of the seventy participants, forty (40) were male and thirty (30) were female. All three groups took a pre-test consisting of three forty-yard dashes with the best time recorded. The control group participated in regular physical education classes for the entire nine week period. Experimental group one was exposed to specificity training for a period of nine weeks. Experimental group two participated in resistance training for nine weeks. The specific exercise programs were incorporated into the physical education classes which met five days a week for ninety minutes each session. At the end of the nine week training period, all three groups were given a post-test. The post-test also consisted of running three, forty-yard sprints with the best time recorded. Height, weight, and body fat measurements of all participants were taken.

Main Research Question

What is the effect of resistance and specificity training on foot speed for middle school students?

The following table shows descriptive statistics for each group on pre- and post-test. The mean values and standard deviations were calculated to be compared and analyzed.

Table One
Comparative Mean Table

	$\bar{x}$	SD	$\bar{x}$	SD
	Pre	Pre	Post	Post
Exp Group One	6.628	1.011	6.574	.982
Exp Group Two	6.168	.632	6.041	.623
Control Group	6.678	.8	6.717	.915

SubHypothesis

To show initial differences between groups, a t-test was performed comparing pre-test scores of all three groups. The following tables show the results:

Table Two
t-table

	t	∝
Pre Control vs Pre Specificity	0.22	0.83

An α–level of 0.83 indicated there was no significant difference initially between the control group and the group of students who received specificity training.

Table Three
t-table

	t	∝
Pre Control vs. Pre Resistance	2.24	0.0371

The t-test had an α–level of 0.0371 which showed no significant difference initially between the control group and the group of students who received resistance training. An α-level of 0.025 or less would indicate a significant difference on a two-tailed test.

Table Four
t-table

	t	∝
Pre-Resistance vs. Pre-Specificity	1.74	0.973

An a-level of 0.0973 also showed no significant difference initially between the group of students who received specificity training compared to the group of students who received resistance training.

To show significant differences between intra groups, a t-test was performed to compare pre-test and post-test scores of all three groups. The following tables show the results:

Table Five
t-table

	t	∝
Pre-Control vs. Post Control	-0.70	0.491

An α–level of 0.491 indicated no significant difference between scores of students in the control group.

Table Six
t-table

	t	∝
Pre-Specificity vs Post Specificity	0.96	0.3461

The t-test had an α-level of 0.3461 which showed no significant difference after specificity training.

Table Seven
t-table

	t	α
Pre-Resistance vs Post-Resistance	1.63	0.12

An α–level of 0.12 showed no significant difference after resistance training.

To show significant differences between inter groups, a t-test was performed to compare post-test scores of all three groups. The following tables show the results:

Table Eight
t-table

	t	α
Post-Control vs Post-Specificity	0.64	0.5277

The t-test had an α–level of 0.5277 which indicated no significant difference between post-test scores of students in the control group and those in the specificity group.

Table Nine
t-table

	t	α
Post-control vs Post Resistance	2.65	0.016

An α–level of 0.016 showed there was a significant difference between post-test scores of students in the control and those who received resistance training.

Table Ten
t-table

	t	a
Post-specificity vs Post Resistance	2.41	0.0261

An α–level of 0.0261 indicated no significant difference between post-test scores of students who received specificity training and those who received resistance training. However, this was very close to 0.025, which would have indicated a significant difference with a two-tailed test.

To show initial significant differences between gender groups, a t-test was performed comparing pre-test scores of all three groups separated into male and female. The following tables show the results:

Table Eleven
t-table (male)

	t	α
Pre-Control vs Pre Specificity	0.63	0.5392

An α–level of 0.5392 indicated no significant difference initially between scores of male students in the control group and the specificity group.

Table Twelve
t-table (male)

	t	α
Pre-Control vs Pre-Resistance	1.01	0.3302

The t-test had an α–level of 0.3302 which showed no significant difference initially between scores of male students in the control group and resistance group.

Table Thirteen
t-table (male)

	t	α
Pre-Specificity vs Pre-Resistance	-0.13	0.8984

An a-level of 0.8984 showed no significant difference initially between scores of male students in the specificity group and the resistance group.

Table Fourteen
t-table (female)

	t	α
Pre-Control vs Pre-Specificity	-0.58	0.5733

The t-test had an α-level of 0.5733 which indicated no initial significant differences between scores of female students in the control group and specificity group.

Table Fifteen
t-table (female)

	t	α
Pre-Control vs Pre-Resistance	6.26	0.0033

An α-level of 0.0033 clearly indicated there was an initial significant difference between scores of female students in the control group and the resistance group.

Table Sixteen
t-table (female)

	t	α
Pre-Specificity vs Pre-resistance	2.47	0.0693

The t-test had an α-level of 0.0693 which showed no initial significant difference between female students in the specificity group and the resistance group.

To show significant differences between intra gender groups, a t-test was performed to compare pre-test and post-test scores of all three male groups and all three female groups. The following tables show the results:

Table Seventeen
t-table (male)

	t	α
Pre-Control vs Post Control	1.24	0.2399

The t-test had an α-level of 0.2399 which showed no significant difference between scores of male students in the control group.

Table Eighteen
t-table (male)

	t	α
Pre-Specificity vs Post-Specificity	-0.22	0.8273

An α-level of 0.8273 indicated no significant difference between scores of male students who received specificity training.

Table Nineteen
t-table (male)

	t	α
Pre-Resistance vs Post-Resistance	1.71	0.1102

The t-test had an α-level of 0.1102 which indicated no significant difference between scores of male students who received resistance training.

Table Twenty
t-table (female)

	t	α
Pre-Control vs Post-Control	-1.63	0.1344

An α-level of 0.1344 indicated no significant difference between scores of female students in the control group.

Table Twenty-One
t-table (female)

	t	α
Pre-Specificity vs Post-Specificity	1.94	0.0843

An α-level of 0.0843 showed no significant difference between scores of female students who received specificity training.

Table Twenty-Two
t-table (female)

	t	α
Pre-Resistance vs Post-Resistance	1.62	0.1803

The t-test had an α-level of 0.1803 which indicated no significant difference between scores of female students who received resistance training.

To show significant differences between inter gender groups, a t-test was performed to compare post-test scores of all three male groups and all three female groups. The following tables show the results:

Table Twenty-Three
t-table (male)

	t	α
Post-Control vs Post-Specificity	0.33	0.7506

An α-level of 0.7506 indicated no significant difference between post-test scores of male students in the control group and those who received specificity training.

Table Twenty-Four
t-table (male)

	t	α
Post-Control vs Post Resistance	1.16	0.2684

The t-test had an α-level of 0.2684 which indicated no significant difference between post-test scores of male students in the control group and those who received resistance training.

Table Twenty-Five
t-table (male)

	t	α
Post-Specificity vs Post-Resistance	0.57	0.5747

An α-level of 0.5747 indicated no significant difference between post-test scores of male students who received specificity training and those who received resistance training.

Table Twenty-Six
t-table (female)

	t	α
Post-Control vs Post-Specificity	0.30	0.7684

The t-test had an α-level of 0.7684 which indicated no significant difference between post-test scores of female students in the control group and those who received specificity training.

Table Twenty-Seven
t-table (female)

	t	α
Post-Control vs Post-Resistance	6.04	0.0038

An α-level of 0.0038 clearly showed there was a significant difference between post-test scores of female students in the control group and those who received resistance training.

Table Twenty-Eight
t-table (female)

	t	α
Post-Specificity vs Post-Resistance	2.65	0.0571

An α-level of 0.0571 indicated no significant difference between post-test scores of female students who received specificity training and those who received resistance training.

The following table compares the height, weight, and percent of body fat for the groups. Although students selected for this study were placed in groups randomly, analysis of the means related to height and weight seem to indicate that the students in the resistance group had the more athletic frame. This could possibly give them an overall advantage in their ability to make gains in foot speed over the nine week training period. Physiologically the other two groups may not have been able to make the same gains. However, an examination of the percentage of body fat for the three groups shows that the resistance group had less body fat percentage than the control group, but slightly more than the specificity group. This indicates that the physical condition levels of the three groups were relatively equal.

Table Twenty-Nine
Mean and Standard Deviation Table
Group Physical Data

	Height		Weight		% Body Fat	
	Mean	SD	Mean	SD	Mean	SD
		3.91237		36.2607		12.430205
Control	63.84	3.83332	129.44	35.5281	25.48	12.179064
		3.65239		34.0072		6.81737
Specificity	63.44	3.57860	134.36	32.0120	24.68	6.67964
		2.855742		19.2169		4.625728
Resistance	65.55	2.78343	121.85	18.7303	24.85	4.508602

Chapter Five: Summary, Conclusions and Recommendations

Summary

This study involved seventy seventh and eighth grade students enrolled in Montcalm Middle School. The students were randomly selected and placed in one of three groups. All three groups participated in a pre-test of three forty-yard sprints, recording the best time of the three. After a nine-week period of no structured exercise, the control group was tested again, running a series of three forty-yard sprints recording the best time. Experimental group one, the specificity group, followed a nine-week specificity training routine. This group ran a series of timed sprints three days a week for the entire nine week training period. Experimental group two, the resistance group, was exposed to a routine of weight lifting, plyometric training, chute training, and power belt resistance training for nine weeks. Both experimental groups ran three forty-yard sprints recording the best time at the conclusion of the nine week training period.

The goal of this study was to determine if running speed would significantly increase when this age group was exposed to certain training methods as opposed to increases that naturally take place during this period of time. This study showed that running speeds did not increase significantly because of specificity training, but did increase with resistance training. A comparison of mean values and a series of t-tests were performed to reach these conclusions. The design for this investigation was an experimental, three group, pre-test/post-test design. The data were analyzed using a t-test of gain scores.

Conclusions

Results showed that a significant difference was not observed in groups with specificity training, although resistance training did have a significant increase in some test results. A comparison of mean values showed that resistance training improved running times more than specificity training. For the specificity training group, the mean score on the pre-test was 6.628 while on the post-test it decreased to 6.574, a decrease of .054 seconds. The resistance group had a pre-test score of 6.168 and a post-test score of 6.041, a decrease in time of .127. The control group did not decrease times from pre- to post-test. The mean score on the pre-test was 6.678 and 6.717 on the post-test.

A t-test performed on the data indicated no significant difference with specificity training. An ∝ level of .3461, which resulted from a t-score of .961, was achieved when pre-test scores of the specificity group were compared to post-test scores. This clearly indicated there was no significant difference. Also, when post-test scores of the control group were compared to the specificity group, an ∝ level of .5277 was achieved. This also indicated no significant difference was obtained.

Performing a t-test on the data indicated a significant difference with resistance training. An ∝ level of .1712, which resulted from a t-score of 1.422 was achieved when pre-test scores were compared to post-test scores of the resistance group. This indicated no significant difference. An ∝ level of .016 was achieved with a t-score of 2.645, when post-test scores of the control group were compared to post-test scores of the resistance group. Clearly, there was a significant difference indicated here. When post-test scores of the resistance group were compared to post-test scores of the specificity group, an ∝ level of

.0261 was achieved with a t-score of 2.413. An ∝ level of .025 or less would indicate a significant difference on a two-tailed test. The level achieved, .0261, was very close to the rejection region even though it indicated no significant difference.

Tests were also performed to determine any gender differences with each type of training. Three t-tests were performed to compare intra-gender groups. Pre-test and post-test scores of the control group, specificity group, and resistance group all had t-values which indicated no significant difference between male students. For the control group, an α-level of 0.2399 was achieved. An α-level of 0.8273 was obtained for the specificity group. The resistance group had an α-level 0.1102 when a t-test was performed. No significant differences were found with female students either when comparing intra-groups. For the control group, an α-level of 0.1344 was obtained. The specificity group had an α-level of 0.0843 and the resistance group had an α-level of 0.1803 when t-tests were performed.

Inter-gender groups were also compared with t-tests. Three tests showed no significant differences between male students after specificity or resistance training. An α-level of 0.7506 was achieved from a t-test comparing post-control to post-specificity. Post-control vs post-resistance obtained an α-level of 0.2684 when the t-test was performed. An α-level of 0.5747 was obtained when post-specificity was compared to post-resistance. When female inter-groups were compared, a significant difference was found between post-control and post-resistance only. An α-level of 0.0038 was obtained when a t-test was performed which compared these two groups. An α-level of 0.7684 was achieved between the control group and specificity group for females. An α-level of 0.0571 was achieved between the post-specificity and post-resistance for females. Clearly, both of these indicated no significant difference.

Other t-tests were performed to show initial differences between gender groups. Pre-tests were compared for all three groups, for males, and then females. No initial significant differences were found for the male students. For the females, an α-level of 0.0033 was obtained when pre-control was compared to pre-resistance. This clearly indicated a significant difference initially. The main research question was: "Will seventh and eighth grade students significantly increase foot speed by participating in a specific training routine then which occur because of natural maturation process for this age?" The results indicated that increases in foot speed were not achieved by specificity training but were achieved through resistance training.

Recommendations:

A possibility for further research could include a longer training period. This study used a nine week time frame. Longer training may make a greater difference than is made through maturity. Further research could also include an analysis of changes in muscular strength for each subject that may have occurred during the allotted time frame. Also, a comparison could be done with different age groups. While this sample was adequate for the purpose of this study, a larger sample might be advisable and may produce more general results. Further research could also include a comparison of percent body fat and weight and the effect of these factors on running speed with the two different training methods. Further research is important on this subject in order that information can be gained on the most beneficial methods of achieving higher scores and greater student success. With this knowledge, schools could restructure their curricula to incorporate different training routines in physical education classes on a full-time basis. This could prove to be an asset to student achievement in class and in athletic competitions.

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